



Brain Development and Early Learning

Research on Brain Development

For decades researchers have been aware of the extraordinary development of a child's brain during the first five years of life. Recent advances in neuroscience have helped crystallize earlier findings, bringing new clarity and understanding to the field of early childhood brain development. Children are born ready to learn. They cultivate 85 percent of their intellect, personality and skills by age five. The first months and years of life set the stage for lifelong development.ⁱ Because of the importance of early brain development, what happens in the early years has serious implications for public policy that will be explored later in this paper.



With the neuroscience of brain development unfolding, we now know that (1) the way a brain develops hinges on the complex interplay between the genes a person is born with and the experiences a person has from birth on; (2) it actually takes up to 12 years for the brain to become fully organized, with parts of the cortex still to become organized through the later teen years; (3) the quality of an infant's relationship with his or her primary caregivers has a decisive impact on the architecture of the brain, affecting the nature and extent of adult capabilities; and (4) early interactions directly affect the way the brain is "wired," and do not merely create a context for development.

The human brain develops more rapidly between birth and age five than during any other subsequent period.

The 100 billion neurons that humans are born with make connections through synapses, "wiring" the brain for action. The experiences an individual has impact the types

and amount of synaptic connections that are made. Synaptic connections begin prior to birth and are created at a rapid rate through age three. The brain operates on a "use it or lose it" principle. Only those connections and pathways that are activated frequently are retained. Other connections that are not consistently used will be pruned or discarded so the active connections can become stronger.ⁱⁱ

The preschool years are the time in which the brain begins to maximize efficiency by determining which connections to keep and which to eliminate.

Providing Repeated Positive Experiences is Critical

For children's brains to become highly developed for learning, repeated experiences are essential. Connections become stronger and more efficient through repeated use. Reading to children every day, for example, helps strengthen essential connections. Connections are also made stronger when children have daily opportunities to develop both large- and small-muscle skills, have the chance to practice developing social skills, and interact directly with their environment. It is vital to incorporate rich language into all of these activities, since exposure to rich language creates the foundation for a child's use and understanding of words, and increases the likelihood of reading success at a later age.

Research shows that the richness of a young child's verbal interactions has a dramatic effect on vocabulary and school readiness, with differences correlated to socio-economic status. A watershed study on the topic found that by age 3, the observed cumulative vocabulary for children in professional families was 1,116 words; for working class families it was about 740, and for welfare families 525.

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- Brainstem**—regulates blood pressure, heart rate, and body temperature
- Midbrain**—motor regulation and sleep
- Limbic**—attachment, sexual behavior, emotional reactivity
- Cortex**—abstract and concrete thought

Basics of Brain Structure

The brain grows in sequential fashion, from bottom (brainstem) to top (cortex), or from the least complex functioning to the most complex. By age three, 85 percent of the core structures of the brain are formed.

“The characteristics of learning readiness are developed rather than taught and only through numerous concrete interactions with the world can a young child prepare to benefit from formal instruction later.”
—David Elkind, noted author on child development

To develop the higher areas of the brain, children must be able to experience things for themselves and feel the sense of accomplishment that goes along with completing tasks independently. To support this, adults need to allow (not force) enough time for children to try things over and over again. In this way, the brain is reassured that what is learned is true. However, children need someone available to help and encourage them when things get overwhelming, and to support them in new situations. Children feel comfortable and develop a continued sense of excitement toward learning when caring adults provide structure and appropriate stimulation.

The brains of preschoolers are working to create organization through consistency. It is essential that routines and limits for preschool children be established and are adhered to. Preschool children’s brains have a lot of plasticity and also vulnerability to their environment, and will therefore continually adapt to what they are exposed to. Environments that are chaotic, disorderly or highly stressful have a direct negative influence on the development of the cortex.

“A child does not learn from a passive kaleidoscope of experiences but from the outcomes of actions that he or she has initiated.”
—John Keith Brierley, author of *Give Me a Child Until He Is Seven: Brain Studies and Early Childhood Education*

Early Learning Programs Impact the Developing Brain

Early learning programs that are appropriate for a child’s developmental level provide opportunities to learn through play and hands-on exploration. Through this type of learning, children test new knowledge in a relaxed setting and then naturally relate it to existing knowledge and store the new information.

“Learning progress may actually be slowed by overly academic preschool experiences that introduce formalized learning experiences too early for a child’s developmental status.”
—Rebecca Marcon, Developmental Psychologist

According to Jane Healy, a well-respected educational psychologist, “Early childhood programs that implement a directed academic curriculum often replace essential, hands-on learning activities with skill-based performance and rote-learning tasks. In doing so, they risk the developmental growth necessary for children’s future academic success.”ⁱⁱⁱ Experts believe that when rote-learning tasks are used extensively in an early childhood classroom or other setting, normal growth and development of the brain can become distorted.





Through increased understanding of brain development, we know what young children need most. Whether at home or in a formal early education setting, children will develop best if they are provided with:

- Positive, reliable and supportive relationships
- Regular routines and consistency
- Chances to repeat activities
- Opportunities to learn through hands-on interaction
- Exposure to rich, interactive language
- Novel ways to learn

Public Policy Implications

What does this research on early childhood brain development mean for public policy? To what extent should states and communities take public action to improve early learning? Should families be expected to manage on their own? These questions have provided the basis for growing public debate about investments in early care and education.

Profound Societal Changes

After reviewing a quarter century of research, scholars convened by the National Research Council concluded that profound social and economic transformations are posing serious challenges to the efforts of parents and others to ensure proper early childhood development.^{iv}

These changing conditions include:

- The remarkable growth in the number of working mothers with young children. In 2004, 66 percent (approximately 267,000) of all children under six in Wisconsin had all parents in the labor force, one of the highest percentages in the nation.^v
- The rise in divorce and in poor single-parent families. Wisconsin's divorce rate has doubled over the last 30 years, and nearly one quarter of children live in single-parent families.

It appears that many of Wisconsin's parents are struggling in their efforts to assure that their children are safe, healthy, and prepared for school. Most developed countries far surpass the United States in their early care and education services.

Evidence of Benefits of High Quality Early Care and Education

Mounting evidence indicates that effective, well-planned early care and education programs can positively supplement parents' efforts, and have dramatic positive impacts on children's school success. This success carries over into their adult lives.

“The policy issue is not one of getting children “ready to learn”, but rather one of appreciating that they are born to learn and crafting policies and programs that actively build on their considerable capabilities.”

—National Research Council, 2000

According to James Heckman, University of Chicago Economist and Nobel Laureate, investments in high-quality early education programs have the highest rate of return of any social investment.^{vi} The Committee for Economic Development, an independent, nonpartisan think tank, concluded that high quality preschool programs offer societal benefits that far outweigh program costs by improving the later education, employment, earnings and crime outcomes of students who attend preschool.^{vii} A strong body of research indicates that investing in rich learning experiences for low-income children produces particularly high returns, while new research shows encouraging impacts on middle-class children with exposure to well-designed preschool programs.

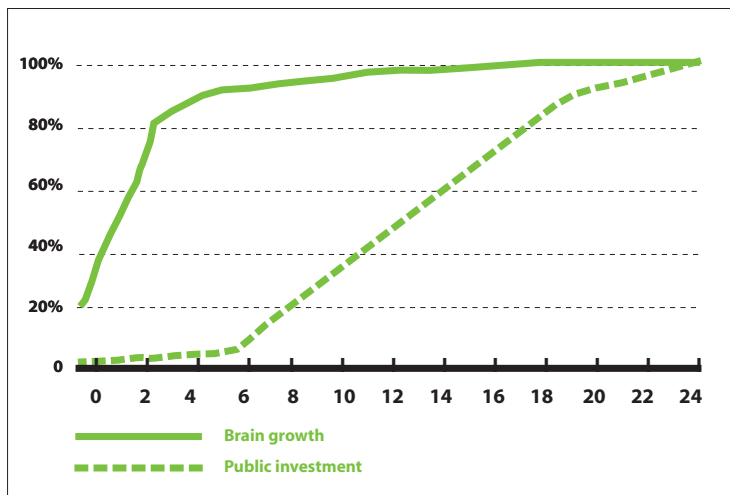
Some argue that investments in early care and education are wiser than those made at any other age. The graph below illustrates the trajectory of brain development compared to public investment, by age. It is striking that while 85 percent of a child's



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Brain Growth and Public Investment



Source: *Early Learning Left Out, Voices for America's Children and the Child and Family Policy Center, 2004.*

core brain structure is formed by age five, less than 4 percent of public investments on education and development have occurred by that time.

Three factors combine to present a strong case for a new public policy that invests more in young children's development and education: the growing body of research of the importance of the first five years in brain development and school readiness; the changing pressures on Wisconsin's families; and the promising evidence of the positive long-term effects from investing in early learning programs. The research and experience of the last quarter century logically lead to a call for Wisconsin to review its current investments in early education and to design a more coherent system of early care and education services. For more information on specific policy changes, go to www.wccf.org.



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Endnotes

- ⁱ National Research Council and Institute of Medicine.2000, *From Neurons to Neighborhoods: The Science of Early Childhood Development*. Washington, D.C.: National Academy Press.
- ⁱⁱ Hart, B. & Risley, T. 1995. *Meaningful Differences in the Everyday Experience of Young American Children*. Baltimore, MD: Brookes Publishing.
- ⁱⁱⁱ Healy, J.M. 2004. *Your child's growing mind*. New York: Broadway Books.
- ^{iv} National Research Council and Institute of Medicine.2000, *From Neurons to Neighborhoods: The Science of Early Childhood Development*. Washington, D.C.: National Academy Press.
- ^v 2006 Kids Count. The Annie E. Casey Foundation.
- ^{vi} Heckman, J. 2005. *Lessons from the Technology of Skill Formation*.
- ^{vii} Committee of Economic Development. 2006. *The Economic Promise of Investing in High-Quality Preschool: Using Early Education to Improve Economic Growth and the Fiscal Sustainability of States and the Nation*.
- ^{viii} Barnett, W.S., Lamy, C., & Jung, K. 2005. *The Effects of State Prekindergarten Programs on Young Children's School Readiness in Five States*. Rutgers University: The National Institute for Early Education Research.

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